JC20 Rec'd PCT/PTO 25 FEB 2002

FORM PTO-1390 (Modified) (REV 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		ATTORNEY'S DOCKET NUMBER 112740-541 U S. APPLICATION NO (IF KNOWN, SEE 37 CFR 10/069418
INTERNATIONAL APPLICATION NO. PCT/DE00/02859	INTERNATIONAL FILING DATE 22 August 2000	PRIORITY DATE CLAIMED 27 August 1999

TITLE OF INVENTION
METHOD FOR ALLOCATING TRANSMISSION RESOURCES TO THE UPLINK IN A RADIO TRANSMISSION

APPLICANT(S) FOR DO/EO/US
Christian Menzel

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include itens (5), (6), (9) and (24) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   - a. ☒ is attached hereto (required only if not communicated by the International Bureau).
   - b. ☐ has been communicated by the International Bureau.
   - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   - a. ☒ is attached hereto.
   - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C 371 (c)(3))
   - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   - b. ☐ have been communicated by the International Bureau.
   - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☒ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☒ Certificate of Mailing by Express Mail
23. ☐ Other items or information:

JC13 Rec'd PCT/PTO 25 FEB 2002

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/088418	PCT/DE00/02859	112740-541

24. The following fees are submitted:.	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :		
☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**		
☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**		
☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**		
☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**		
☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	**$890.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).	**$0.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	12 - 20 =	0	x $18.00	**$0.00**	
Independent claims	1 - 3 =	0	x $84.00	**$0.00**	
Multiple Dependent Claims **(check if applicable).**			☐	**$0.00**	
TOTAL OF ABOVE CALCULATIONS =				**$890.00**	
☐ Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				**$0.00**	
SUBTOTAL =				**$890.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +				**$0.00**	
TOTAL NATIONAL FEE =				**$890.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).** ☐				**$0.00**	
TOTAL FEES ENCLOSED =				**$890.00**	
				Amount to be: refunded	$
				charged	$

a. ☒ A check in the amount of **$890.00** to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. ________ in the amount of ________ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **02-1818** A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

William E. Vaughan (Reg. No. 39,056)
Bell, Boyd & Lloyd LLC
P.O. Box 1135
Chicago, Illinois 60690
312-807-4292

SIGNATURE

William E. Vaughan
NAME

39,056
REGISTRATION NUMBER

February 25, 2002
DATE

10/069418

JC13 Rec'd PCT/PTO 25 FEB 2002

BOX PCT

IN THE UNITED STATES ELECTED/DESIGNATED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANT:	Christian Menzel	DOCKET NO.:	112740-541
SERIAL NO:		GROUP ART UNIT:	
FILED:		EXAMINER:	
INTERNATIONAL APPLICATION NO::		PCT/DE00/02859	
INTERNATIONAL FILING DATE		22 August 2000	
INVENTION:	METHOD FOR ALLOCATING TRANSMISSION RESOURCES TO THE UPLINK IN A RADIO TRANSMISSION		

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

Please amend the above-identified International Application before entry into the National stage before the U.S. Patent and Trademark Office under 35 U.S.C. §371 as follows:

In the Specification:

Please replace the Specification of the present application, including the Abstract, with the following Substitute Specification:

10/069418
JC13 Rec'd PCT/PTO 25 FEB 2002

SPECIFICATION

TITLE OF THE INVENTION

METHOD FOR ALLOCATING TRANSMISSION RESOURCES TO THE UPLINK IN A RADIO TRANSMISSION

BACKGROUND OF THE INVENTION

The present invention relates to a method for allocating transmission resources to the uplink from subscriber stations to a base station in a radio communications system.

In radio communications systems, messages (speech, image information or other data) are transmitted via transmission channels using electromagnetic waves (radio interface). The messages are transmitted both in the downlink from the base station to the subscriber station and in the uplink from the subscriber station to the base station.

DE 198 10 285.2 discloses that the signal sources are distinguished, and hence the signals are evaluated, using methods known as frequency division multiplexing (FDMA), time division multiplexing (TDMA) or code division multiplexing (CDMA), which also can be combined with one another. One form of time division multiplexing (TDMA) is the TDD (time division duplex) transmission method, in which a common frequency band is used to transmit both in the uplink (i.e., from the base station to the subscriber station), and in the downlink from the subscriber station to the base station.

To transmit data between two communications terminals, it is possible to call upon connection-oriented concepts and concepts based on logical connections. For connection-oriented data transmissions, it is necessary to provide transmission resources between the two communications terminals throughout the data transmission.

For data transmission using logical connections, permanent provision of transmission resources is not necessary. An example of such data transmission is packet data transmission. In this case, there is a logical connection between the two subscriber stations throughout data transmission, but transmission resources are provided only during the actual transmission times for the data packets. This method is based on transmission of the data in short data packets, between which relatively

long breaks can arise. In the breaks between the data packets, transmission resources are available for other logical connections. With reference to one logical connection, transmission resources are saved.

The packet data transmission method known from German patent specification DE 44 02 930 A1 is particularly suitable for communications systems with limited transmission resources. However, it was developed for transmitting non-time-critical information, where delay times in transmitting the information, particularly in the uplink, are not relevant. The base station in a communications system can react to time-critical information arriving in the network by appropriately classifying the transmission resources in the downlink. For the uplink, this is not possible, since allocation of the radio resources is performed in the network. In particular, it is not possible to coordinate the subscriber stations with one another, such that information can be transmitted only with very long delays.

DE 197 34 935 discloses a method in which a base station takes a request as a basis for allocating transmission resources in the uplink to this subscriber station. However, the request is made by the subscriber station using a multiple access operation, which is known from the GSM mobile radio system, for example. The complex signaling and the likelihood of collision during multiple access results in very long delay times having to be accepted.

The present invention is, therefore, directed toward a method for allocating transmission resources for the transmission of information which is more appropriate for time-critical applications.

SUMMARY OF THE INVENTION

In the inventive method for allocating transmission resources to the uplink in a radio interface between subscriber station (MS) and a base station (BS) in a TD-CDMA communications system, a number of time slots are combined in one frame for the radio interface. The transmission resources can be respectively allocated to a subscriber station for data transmission, the transmission resources being defined by a frequency band, a spreading code and a time slot. Spreading codes are also known within a CDMA system as CDMA codes.

A first signaling channel, formed by the transmission resources of a time slot, within the frame contains a number of subchannels. The subchannels are defined by

spreading code for the transmission resource and transmission time within the time slot. A first portion of the subchannels is used by the subscriber stations for random multiple access, and a second portion of the subchannels is exclusively allocated to subscriber stations for the purposes of signaling within logical connections.

In contrast to the subchannels, used by the random multiple access, of the first portion, the subchannels of the second portion are exclusively allocated to subscriber stations. Since random multiple access involves a number of subscriber stations being able to access a subchannel of the first portion simultaneously, a collision is likely. For exclusively allocated subchannels of the second portion, on the other hand, a collision can be ruled out and, hence, the delay before the use of the transmission resources for time-critical information in the uplink is significantly reduced.

Due to the exclusive allocation, additional signaling in the downlink to confirm the signaling to the subscriber station, as is customary during random multiple access, is not necessary. In this case, the subscriber station does not wait for confirmation, but rather immediately starts to transmit the time-critical information.

To increase the reliability of signaling, additional confirmation is advantageous if the transmission conditions hold a risk of incorrect signaling. In this case, the subscriber station waits for confirmation by the base station before transmitting the time-critical information.

For the purposes of signaling in logical connections, the inventive method requires only few resources for signaling, such that signaling is effected in just a few milliseconds.

In one advantageous embodiment of the present invention, the split of the subchannels into the first and second portions is configured by the base station and is signaled to the subscriber stations via a general signaling channel.

In contrast to fixed splitting of the subchannels, configuration by the base station permits matching to various criteria, for example to the volume of radio traffic. Thus, the split can be configured on the basis of the number of existing connections, the number of random multiple access operations or the number of logical connections for transmitting time-critical information.

Advantageously, the split is configured cyclically. With cyclic configuration, the resources required for signaling the configuration are used more effectively. If the

configuration is updated cyclically only every 30 seconds, for example, the amount of resources used up is very small.

With particular advantage, the second portion of the subchannels is provided for collision-free signaling of requests by the subscriber station for transmission resources for transmitting time-critical information.

The transmission of time-critical information presupposes that the delay before transmission resources are used is short. For transmitting voice information, the delay must not exceed 100 milliseconds. To use the transmission resources effectively in the uplink, the present invention proposes that, during breaks in the transmission of time-critical information, non-time-critical information be transmitted by other subscriber stations using the same transmission resource.

The inventive method guarantees that the delay before the transmission resource is used for transmitting the time-critical information does not exceed a maximum value. The maximum value is significantly below that for random multiple access and, with a suitable choice of other system parameters (shallow interleaving depth), is less than 40 milliseconds.

With particular advantage, an exclusive allocation of a transmission resource to the respective subscriber station is temporarily canceled during the breaks in the transmission of time-critical information signaled by the subscriber station, and the transmission resource is used to transmit non-time-critical information from other subscriber stations to the base station within a logical connection.

The breaks in the transmission of time-critical information are detected by the base station. In this case, various methods are advantageously used for detection which also can be combined with one another.

First, the breaks are detected by evaluating the signaling in the subchannel of the second portion. The subchannel is exclusively allocated to the subscriber station transmitting time-critical information. If, by way of example, the subscriber station sends no signaling in the subchannel, the base station makes the transmission resource used available for transmitting non-time-critical information from other subscriber stations.

Second, the breaks are detected by evaluating an interruption in the data stream. If transmission of the time-critical information is interrupted, then a break is

established after a fixed time interval or a time interval configured on the basis of transmission conditions or the load of radio traffic, and the base station makes the transmission resource used available for transmitting non-time-critical information from other subscriber stations.

Third, the breaks are detected by virtue of the time-critical information containing signaling relating to an interruption in the transmission of the time-critical information evaluated by the base station or a network device.

Applications using non-time-critical information are, by way of example, e-mail, or Internet data, for which only a low quality of service (QoS) is required. Such information also can be transmitted with a relatively long delay.

The base station advantageously takes the request as a basis for signaling termination of the non-time-critical information from the respective other subscriber station and allocation of the transmission resource for transmitting the time-critical information. The signaling is effected, by way of example, simultaneously using a second signaling channel. Thus, the base station controls the distribution of transmission resources in the uplink, without continually needing to allocate a transmission resource exclusively to a transmission of time-critical information. Coordination of the transmissions in the uplink is, therefore, controlled by the base station or a network device.

In an alternative embodiment of the present invention, the second portion of the subchannels is provided for measurements of transmission conditions in the radio interface. During a logical connection, information temporarily is not transmitted. To ensure that the transmission conditions in the radio interface are nevertheless measured during the transmission breaks, a measurement signal is transmitted as signaling in a subscriber station's exclusively allocated subchannels of the second portion. This signaling can be effected, by way of example, cyclically or at the request of the base station. The measurement needs to be updated only at long time intervals; for example, 2 seconds. Exclusive allocation of the subchannel is, thus, effected only for a limited time period controlled cyclically by the base station at relatively long time intervals. Thus, a number of subscriber stations alternately transmit one or more measurement signals within a subchannel which, however, is exclusively allocated in this time slot, such that only few resources are used up.

Advantageously, the measurements of the transmission conditions are evaluated for the purposes of transmitted power regulation, frame synchronization and ascertaining a timing advance.

During long transmission breaks within logical connections, the transmitted power, frame synchronization and timing advance are thus updated cyclically and, hence, a collision due to altered signal delay times is prevented and the interference due to unregulated transmitted powers is reduced.

The subchannels of the second portion advantageously are used for a number of different signaling operations and measurements. Thus, the measurement of the transmission conditions is combined with the collision-free request.

Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Invention and the Figures.

BRIEF DESCRIPTION OF THE FIGURES

FIGURE 1 shows a block diagram of a radio communications system, in particular of a mobile radio system.

FIGURE 2 shows a schematic illustration of the radio interface between base stations and subscriber stations.

FIGURE 3 shows a schematic illustration of the sequence of the inventive method.

DETAILED DESCRIPTION OF THE INVENTION

The radio communications system shown in FIGURE 1 and, by way of example, in the form of a mobile radio system, includes a multiplicity of mobile switching centers SGSN which are networked among one another and set up access to a landline network PDN. In addition, these mobile switching centers SGSN are connected to at least one respective device for allocating radio resources RNC. Each of these devices RNC, in turn, allows a connection to at least one base station BS.

This base station BS is a radio station which can use a radio interface to set up and signal communication links to mobile or fixed subscriber stations MS, MSX, MSS1 and MSS2. The functionality of this structure is used by the inventive method. Use in a wireless subscriber access system (access network), for example, likewise is possible in this context.

From a subscriber station MS to a base station BS, a transmission channel DCH in the uplink is exclusively allocated for the undelayed transmission of time-critical information zki. This transmission channel DCH may include one or more transmission resources UR, as shown in more detail in Figure 2. This transmission channel DCH is designed for the maximum values of greatly fluctuating data rates. Particularly, time-critical applications with greatly fluctuating data rates which are to be transmitted with little delay, such as video transmissions or voice transmissions with an interruption in the transmission during the breaks in speech (VAD, Voice Activity Detection), require an exclusively allocated transmission channel DCH for these services. In this transmission channel DCH, the transmission of time-critical information zki is not delayed by the transmission of non-time-critical information nzki from other subscriber stations MSX.

By contrast, transmission channels DSCH with shared use are not exclusively allocated to a transmission to a number of subscriber stations MSS1 and MSS2. They are used by different subscriber stations MSS1, MS2 for non-time-critical information nzki; for example, delayed transmissions of data packets. For non-time-critical information nzki transmitted in transmission channels with shared use, signaling known from the GPRS system is used, for example, where the much longer delays are accepted by the signaling for the non-time-critical information nzki. The relatively long delay is unacceptable for transmitting time-critical information zki, however.

According to the present invention, in the breaks in the transmission of the time-critical information zki, non-time-critical information nzki from other subscriber stations MSX is additionally transmitted in the same transmission channel DCH. A sequence for the inventive method is illustrated in this regard in FIGURE 3.

An illustrative frame structure for the radio interface in a TDD transmission method can be seen in FIGURE 2. In line with a TDMA component, provision is made for splitting a broadband frequency band fb; for example, having the bandwidth of 5 MHz. A transmission resource UR is defined by a frequency band fb, a spreading code sk and a time slot ts. Good separation is possible using orthogonal spreading codes. A transmission resource UR is the smallest unit which can be allocated to a subscriber station MS, MSX, MSS1 or MSS2 for data transmission. Within a broadband frequency band fb, the consecutive time slots ts are structured on the basis

of a frame structure. Thus, 15 time slots ts0 to ts14 are combined to form one frame rh.

When using the TDD transmission method, some of the time slots ts1 to ts14 are used in the uplink and some of the time slots ts0 to ts14 are used in the downlink, with transmission in the downlink taking place before transmission in the uplink, for example. In between, there is a switching instant SP which is positioned flexibly on the basis of the respective need for transmission channels DCH, DSCH for the uplink and the downlink.

Channel pooling is used to allocate one or more transmission resources UR to a communication link in each case.

The channel pooling method is advantageously used to produce communication links to and from subscriber stations MS, MSX using different data rates or to operate a number of services in parallel on one communication link. To this end, a number of transmission resources UR are combined for transmission for one connection.

Within the frame rh, a first signaling channel RACH in the uplink, the general signaling channel BCCH, and a second signaling channel FACH in the downlink are shown by way of example. While the general signaling channel BCCH and the second signaling channel FACH require only one transmission resource UR, the first signaling channel RACH includes the transmission resources UR of a whole time slot ts.

Below the frame rh, the structure of the first signaling channel RACH is shown. The first signaling channel RACH contains consecutive subchannels SUB defined by spreading code sk and transmission time sts within the time slot ts. A first portion of the subchannels SUB, shown without shading in FIGURE 2, is used by the subscriber stations MS, MSX, MSS1 and MSS2 for random multiple access. In addition, a second portion of the subchannels SUB, shown with shading in FIGURE 2, is exclusively allocated to subscriber stations MS for signaling; for example, signaling the transmission of time-critical information zki within existing logical connections.

The split of the subchannels SUB into the first and second portions is configured by the base station BS and is signaled to the subscriber stations MS, MSX, MSS1 and MSS2 via the general signaling channel BCCH. By way of example, all the transmission times sts for a spreading code sk are allocated to one portion of the subchannels SUB (not shown in FIGURE 2).

Alternatively, all the spreading codes sk for a transmission time sts are allocated to one portion of the subchannels. FIGURE 2 shows a free split by the base station BS, as configured on the basis of the number of random multiple access operations, for example.

FIGURE 3 shows, schematically, the sequence of the inventive method between a base station BS and two subscriber stations MS and MSX. In this example, the subscriber station MS needs to transmit time-critical information zki to the base station BS. While the subscriber station MSX needs to transmit only non-time-critical information nzki to the base station BS. The sequence takes place along a time axis t.

In step 1, signaling information is transmitted from the base station BS to the subscriber stations MS and MSX via the general signaling channel BCCH. In this case, some of the signaling information is the split for the subchannels SUB of the first signaling channel RACH into a first portion for random multiple access and into a second portion for signaling within existing logical connections.

To set up a logical connection, the subscriber station MS evaluates the signaling information in step 2. The user uses the subscriber station MS to request one or more transmission resources UR for the logical connection in order to transmit time-critical information zki. To this end, the subscriber station MS uses a random multiple access method in step 3 to send signaling to request the transmission resources UR for the time-critical information zki to the base station BS in the first portion of the subchannels SUB of the first signaling channel RACH.

To set up a further logical connection, the subscriber station MSX evaluates the signaling information instep 4. The user uses the subscriber station MSX to request at least the further logical connection for transmitting non-time-critical information nzki. To this end, the subscriber station MSX uses a random multiple access method in step 5 to send signaling to request the connection for the non-time-critical information nzki to the base station BS in the first portion of the subchannels SUB of the first signaling channel RACH.

In step 6, the base station BS evaluates the signaling received in the first signaling channel RACH. For both subscriber stations MS and MSX, logical connections are set up and signaled. To set up the connections, further signaling is

advantageous (for example, for the purposes of identification or authentication), which are not shown in FIGURE 3 for the sake of simplicity.

The subscriber station MS is exclusively allocated, by way of example, a transmission resource UR within the logical connection. In addition, the subscriber station MS is exclusively allocated a subchannel SUB of the second portion for the purposes of collision-free signaling of requests for the transmission resource UR for transmitting the time-critical information zki. A further exclusively allocated subchannel SUB of the second portion is provided for measurements of transmission conditions in the radio interface.

In step 7, the allocations are signaled to the subscriber station MS. In step 8, the allocations are signaled to the subscriber station MSX; for example, in the second signaling channel FACH. The subscriber station MSX then enters standby mode. Beforehand, in step 6, the subscriber station MSX is allocated the same transmission resource UR within a further logical connection for transmitting the non-time-critical information nzki. In addition, the subscriber station MSX is allocated a subchannel SUB of the second portion for measurements of transmission conditions in the radio interface. These subchannels SUB for measurement for the two subscriber station MS and MSX are transmitted alternately using the same spreading code sk and transmission time sts but in different frames.

In step 9, data are available for transmission in the subscriber station MS and, in step 10, the subscriber station MS subsequently sends the request for the transmission resource UR to the base station BS continuously in the subchannel SUB of the first portion. The base station makes the transmission channel DCH available in step 11 and, in step 12, sends the channel available signal to the subscriber station MS in the second signaling channel FACH.

In step 13, the subscriber station MS continues to send the time-critical information zki to the base station BS up until a break (i.e., until there is no time-critical information zki for transmission), so that, from step 14 onward, there is no longer any signaling sent by the subscriber station MS in the subchannel SUB of the first portion for the purposes of requesting the transmission resource UR.

During the described time period for steps 9 to 14, the other subscriber station MSX waits for the opportunity to transmit the non-time-critical information nzki. For

this purpose, the information is buffer-stored in a queue in step 15. During the time period, the other subscriber station MSX sends measurement signals, once or a number of times, to the base station BS in the subchannel SUB in step 16.

When the break in the transmission of the time-critical information zki, which is signaled in step 14, is evaluated, the base station BS sends signaling to make the transmission resource UR available for the non-time-critical information nzki to the other subscriber station MSX in the second signaling channel FACH in step 17. The other subscriber station MSX then sends the information nzki to the base station BS in step 18.

In step 18, the present invention is particularly advantageously combined in connection with a method (ARQ) for repeated sending of incorrectly received data. Data received with interference are detected, signaled to the transmission end and transmitted again by the latter. Particularly for non-time-critical information nzki (for example, packet data for an e-mail), a data packet of the non-time-critical information nzki which has been transmitted only incompletely due to the end of the break in the transmission of the time-critical information zki, is transmitted again within the next break, for example.

An end of the break is signaled by the subscriber station MS in step 19 in the exclusively allocated subchannel SUB of the second portion. The base station BS then simultaneously makes the transmission resource UR available for transmitting the time-critical information zki in step 20 and, in step 21, signals to the other subscriber station MSX that the transmission resource UR has been disabled for transmitting the non-time-critical information nzki.

Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.

ABSTRACT OF THE DISCLOSURE

A method for allocating transmission resources to the uplink in a TD-CDMA radio interface, wherein a number of time slots are combined in one frame, a first signaling channel within the frame contains consecutive subchannels, the subchannels are defined by spreading code and transmission time within the time slot, a first portion of the subchannels is used by subscriber stations for random multiple access, and a second portion of the subchannels is exclusively allocated to subscriber stations for signaling in logical connections.

<u>In the claims</u>:

On page 16, cancel line 1, and substitute the following left-hand justified heading therefor:

<u>CLAIMS</u>

Please cancel 1-12, without prejudice, and substitute the following claims therefor:

13. A method for allocating transmission resources to an uplink in a radio interface between a plurality of subscriber stations and a base station in a communications system, the method comprising the steps of :

combining a plurality of time slots in one frame for the radio interface;

defining the transmission resources by a frequency band, a spreading code and a time slot;

enabling allocation of the transmission resources to a subscriber station for data transmission;

providing a first signaling channel, formed by the transmission resources of a time slot, within the one frame, the first signaling channel containing a plurality of subchannels defined by the spreading code for the transmission resources and transmission time within the time slot;

using a first portion of the subchannels by the subscriber stations for random multiple access; and

exclusively allocating a second portion of the subscriber channels to subscriber stations for signaling within existing logical connections.

14. A method for allocating transmission resources as claimed in claim 13, the method further comprising the steps of:

configuring a split of the subchannels into the first and second portions by the base station; and

signaling the configuration to the subscriber stations via a general signaling channel.

15. A method for allocating transmission resources as claimed in claim 14, wherein the split is configured based on a number of random multiple access operations.

16. A method for allocating transmission resources as claimed in claim 14, wherein the split is configured based on a number of logical connections for transmitting time-critical information.

17. A method for allocating transmission resources as claimed in claim 14, wherein the split is configured cyclically.

18. A method for allocating transmission resources as claimed in claim 14, the method further comprising the step of providing at least one subchannel of the second portion for collision-free signaling of requests by the subscriber stations for transmission resources for transmitting time-critical information.

19. A method for allocating transmission resources as claimed in claim 13, the method further comprising the step of providing at least one subchannel of the second portion for measurements of transmission conditions in the radio interface.

20 A method for allocating transmission resources as claimed in claim 19, the method further comprising the step of evaluating the measurements of the transmission conditions for transmitted power regulation.

21 A method for allocating transmission resources as claimed in claim 19, the method further comprising the step of evaluating the measurements of the transmission conditions for frame synchronization.

22. A method for allocating transmission resources as claimed in claim 19, the method further comprising the step of evaluating the measurements of the transmission conditions for ascertaining a timing advance.

23. A method for allocating transmission resources as claimed in claim 18, the method further comprising the steps of:

temporarily canceling an exclusive allocation of a transmission resource to the respective subscriber station during breaks in the transmission of time-critical information signaled by the respective subscriber station; and

using the transmission resource to transmit non-time-critical information from other subscriber stations to the base station within a logical connection.

24. A method for allocating transmission resources as claimed in claim 23, wherein the base station takes the request as a basis for signaling termination of the transmission of the non-time-critical information from the respective other subscriber station and allocation of the transmission resource for transmitting the time-critical information, using a second signaling channel.

REMARKS

The present amendment makes editorial changes and corrects typographical errors in the specification, which includes the Abstract, in order to conform the specification to the requirements of United States Patent Practice. No new matter is added thereby. Attached hereto is a marked-up version of the changes made to the specification by the present amendment. The attached page is captioned "**Version With Markings To Show Changes Made**".

In addition, the present amendment cancels original claims 1-12 in favor of new claims 13-24. Claims 13-24 have been presented solely because the revisions by red-lining and underlining which would have been necessary in claims 1-12 in order to present those claims in accordance with preferred United States Patent Practice would have been too extensive, and thus would have been too burdensome. The present amendment is intended for clarification purposes only and not for substantial reasons related to patentability pursuant to 35 U.S.C. §§101, 102, 103 or 112. Indeed, the cancellation of claims 1-12 does not constitute an intent on the part of the Applicants to surrender any of the subject matter of claims 1-12.

Early consideration on the merits is respectfully requested.

Respectfully submitted,

(Reg. No. 39,056)
William E. Vaughan
Bell, Boyd & Lloyd LLC
P.O. Box 1135
Chicago, Illinois 60690-1135
(312) 807-4292
Attorneys for Applicants

VERSIONS WITH MARKINGS TO SHOW CHANGES MADE

In The Specification:

The Specification of the present application, including the Abstract, has been amended as follows:

~~Description~~

SPECIFICATION

TITLE OF THE INVENTION

METHOD FOR ALLOCATING TRANSMISSION RESOURCES TO THE UPLINK IN A RADIO TRANSMISSION

BACKGROUND OF THE INVENTION

The present invention relates to a method for allocating transmission resources to the uplink from subscriber stations to a base station in a radio communications system.

In radio communications systems, messages (speech, image information or other data) are transmitted via transmission channels using electromagnetic waves (radio interface). The messages are transmitted both in the downlink from the base station to the subscriber station and in the uplink from the subscriber station to the base station.

DE 198 10 285.2 discloses that the signal sources are distinguished, and hence the signals are evaluated, using methods known as frequency division multiplexing (FDMA), time division multiplexing (TDMA) or code division multiplexing (CDMA), which ~~can~~ also can be combined with one another. One form of time division multiplexing (TDMA) is the TDD (time division duplex) transmission method, in which a common frequency band is used to transmit both in the uplink~~, i.e.~~ (i.e., from the base station to the subscriber station), and in the downlink from the subscriber station to the base station.

To transmit data between two communications terminals, it is possible to call upon connection-oriented concepts and concepts based on logical connections. For connection-oriented data transmissions, it is necessary to provide transmission resources between the two communications terminals throughout the data transmission.

For data transmission using logical connections, permanent provision of transmission resources is not necessary. An example of such data transmission is packet data transmission. In this case, there is a logical connection between the two subscriber stations throughout data transmission, but transmission resources are provided only during the actual transmission times for the data packets. This method is based on transmission of the data in short data packets, between which relatively long breaks can arise. In the breaks between the data packets, transmission resources are available for other logical connections. With reference to one logical connection, transmission resources are saved.

The packet data transmission method known from German patent specification DE 44 02 930 A1 is particularly suitable for communications systems with limited transmission resources. However, it was developed for transmitting non-time-critical information, where delay times in transmitting the information, particularly in the uplink, are not relevant. The base station in a communications system can react to time-critical information arriving in the network by appropriately classifying the transmission resources in the downlink. For the uplink, this is not possible, since allocation of the radio resources is performed in the network. In particular, it is not possible to coordinate the subscriber stations with one another, ~~which means~~ such that information can be transmitted only with very long delays.

DE 197 34 935 discloses a method in which a base station takes a request as a basis for allocating transmission resources in the uplink to this subscriber station. However, the request is made by the subscriber station using a multiple access operation, which is known from the GSM mobile radio system, for example. The complex signaling and the likelihood of collision during multiple access ~~mean that~~ results in very long delay times ~~have~~ having to be accepted.

The present invention is ~~based on the object of specifying~~, therefore, directed toward a method for allocating transmission resources for the transmission of information which is more appropriate for time-critical applications. ~~This object is achieved by the method having the features of patent claim 1. Advantageous developments of the invention can be found in the subclaims.~~

SUMMARY OF THE INVENTION

In the inventive method for allocating transmission resources to the uplink in a radio interface between subscriber station (MS) and a base station (BS) in a TD-CDMA communications system, a ~~plurality~~ number of time slots are combined in one frame for the radio interface. The transmission resources can be respectively ~~be~~ allocated to a subscriber station for data transmission, the transmission resources being defined by a frequency band, a spreading code and a time slot. Spreading codes are also known within a CDMA system as CDMA codes.

A first signaling channel, formed by the transmission resources of a time slot, within the frame contains a ~~plurality~~ number of subchannels. The subchannels are defined by spreading code for the transmission resource and transmission time within the time slot. A first portion of the subchannels is used by the subscriber stations for random multiple access, and ~~additionally~~ a second portion of the subchannels is exclusively allocated to subscriber stations for the purposes of signaling within logical connections.

In contrast to the subchannels, used by the random multiple access, of the first portion, the subchannels of the second portion are exclusively allocated to subscriber stations. Since random multiple access involves a ~~plurality~~ number of subscriber stations being able to access a subchannel of the first portion simultaneously, a collision is likely. For exclusively allocated subchannels

of the second portion, on the other hand, a collision can be ruled out and, hence, the delay before the use of the transmission resources for time-critical information in the uplink is significantly reduced.

~~On account of~~ Due to the exclusive allocation, additional signaling in the downlink to confirm the signaling to the subscriber station, as is customary during random multiple access, is not necessary. In this case, the subscriber station does not wait for confirmation, but rather immediately starts to transmit the time-critical information.

To increase the reliability of signaling, additional confirmation is advantageous if the transmission conditions hold a risk of incorrect signaling. In this case, the subscriber station waits for confirmation by the base station before transmitting the time-critical information.

For the purposes of signaling in logical connections, the inventive method requires only few resources for signaling, ~~which means~~ such that signaling is effected in just a few milliseconds.

In one advantageous ~~refinement~~ embodiment of the present invention, the split of the subchannels into the first and second portions is configured by the base station and is signaled to the subscriber stations via a general signaling channel.

In contrast to fixed splitting of the subchannels, configuration by the base station permits matching to various criteria, for example to the volume of radio traffic. Thus, the split can be configured on the basis of the number of existing connections, the number of random multiple access operations or the number of logical connections for transmitting time-critical information.

Advantageously, the split is configured cyclically. With cyclic configuration, the resources required for signaling the configuration are used more effectively. If the configuration is updated cyclically only every 30 seconds, for example, the amount of resources used up is very small.

With particular advantage, the second portion of the subchannels is provided for collision-free signaling of requests by the subscriber station for transmission resources for transmitting time-critical information.

The transmission of time-critical information presupposes that the delay before transmission resources are used is short. For transmitting voice information, the delay must not exceed 100 milliseconds. To use the transmission resources effectively in the uplink, the present invention proposes that, during breaks in the transmission of time-critical information, non-time-critical information be transmitted by other subscriber stations using the same transmission resource.

The inventive method guarantees that the delay before the transmission resource is used for transmitting the time-critical information does not exceed a maximum value. The maximum value is significantly below that for random multiple access and, with a suitable choice of other system parameters (shallow interleaving depth), is less than 40 milliseconds.

With particular advantage, an exclusive allocation of a transmission resource to the respective subscriber station is temporarily canceled during the breaks in the transmission of time-critical information signaled by the subscriber station, and the

transmission resource is used to transmit non-time-critical information from other subscriber stations to the base station within a logical connection.

The breaks in the transmission of time-critical information are detected by the base station. In this case, various methods are advantageously used for detection which ~~can~~ also can be combined with one another.

First, the breaks are detected by evaluating the signaling in the subchannel of the second portion. The subchannel is exclusively allocated to the subscriber station transmitting time-critical information. If, by way of example, the subscriber station sends no signaling in the subchannel, the base station makes the transmission resource used available for transmitting non-time-critical information from other subscriber stations.

~~Secondly~~ Second, the breaks are detected by evaluating an interruption in the data stream. If transmission of the time-critical information is interrupted, then a break is established after a fixed time interval or a time interval configured on the basis of transmission conditions or the load of radio traffic, and the base station makes the transmission resource used available for transmitting non-time-critical information from other subscriber stations.

~~Thirdly~~ Third, the breaks are detected by virtue of the time-critical information containing signaling relating to an interruption in the transmission of the time-critical information evaluated by the base station or a network device.

Applications using non-time-critical information are, by way of example, e-mail, or Internet data, for which only a low quality of service (QoS) is required. Such information ~~can~~ also can be transmitted with a relatively long delay.

The base station advantageously takes the request as a basis for signaling termination of the non-time-critical information from the respective other subscriber station and allocation of the transmission resource for transmitting the time-critical information. The signaling is effected, by way of example, simultaneously using a second signaling channel. Thus, the base station controls the distribution of transmission resources in the uplink, without continually needing to allocate a transmission resource exclusively to a transmission of time-critical information. Coordination of the transmissions in the uplink is, therefore, controlled by the base station or a network device.

In an alternative ~~refinement~~ embodiment of the present invention, the second portion of the subchannels is provided for measurements of transmission conditions in the radio interface. During a logical connection, ~~temporarily no~~ information is temporarily not transmitted. To ensure that the transmission conditions in the radio interface are nevertheless measured during the transmission breaks, a measurement signal is transmitted as signaling in a subscriber station's exclusively allocated subchannels of the second portion. This signaling can be effected, by way of example, cyclically or at the request of the base station. The measurement needs to be updated only at long time intervals,; for example, 2 seconds. Exclusive allocation of the subchannel is, thus, effected only for a limited time period controlled cyclically by the base station at relatively long time intervals. Thus, a ~~plurality~~ number of subscriber stations alternately transmit one or more measurement signals within a subchannel which, however, is exclusively allocated in this time slot, ~~which means~~ such that only few resources are used up.

Advantageously, the measurements of the transmission conditions are evaluated for the purposes of transmitted power regulation, frame synchronization and ascertaining a timing advance.

During long transmission breaks within logical connections, the transmitted power, frame synchronization and timing advance are ~~thus~~ updated cyclically, and, hence, a collision ~~on account of~~ due to altered signal delay times is prevented and the interference ~~on account of~~ due to unregulated transmitted powers is reduced.

The subchannels of the second portion ~~are~~ advantageously are used for a ~~plurality~~ number of different signaling operations and measurements. Thus, the measurement of the transmission conditions is ~~advantageously~~ combined with the collision-free request.

~~The invention is explained in more detail below using exemplary embodiments with reference to illustrations in the drawings, in which~~

Additional features and advantages of the present invention are described in, and will be apparent from, the following Detailed Description of the Invention and the Figures.

BRIEF DESCRIPTION OF THE FIGURES

FIGURE 1 shows a block diagram of a radio communications system, in particular of a mobile radio system~~,~~.

FIGURE 2 shows a schematic illustration of the radio interface between base stations and subscriber stations~~, and~~.

FIGURE 3 shows a schematic illustration of the sequence of the inventive method.

DETAILED DESCRIPTION OF THE INVENTION

The radio communications system shown in FIGURE 1~~,~~ and, by way of example, in the form of a mobile radio system, ~~comprises~~ includes a multiplicity of mobile switching centers SGSN which are networked among one another and set up access to a landline network PDN. In addition, these mobile switching centers SGSN are connected to at least one respective device for allocating radio resources RNC. Each of these devices RNC, in turn, allows a connection to at least one base station BS.

This base station BS is a radio station which can use a radio interface to set up and signal communication links to mobile or fixed subscriber stations MS, MSX, MSS1 and MSS2. The functionality of this structure is used by the inventive method. Use in a wireless subscriber access system (access network), for example, ~~is~~ likewise is possible in this context.

From a subscriber station MS to a base station BS, a transmission channel DCH in the uplink is exclusively allocated for the undelayed transmission of time-critical information zki. This transmission channel DCH ~~can comprise~~ may include one or more transmission resources UR, as shown in more detail in Figure 2. This transmission channel DCH is designed for the maximum values of greatly fluctuating data rates. Particularly, time-critical applications with greatly fluctuating data rates which are to be transmitted with little delay, such as video transmissions or voice transmissions with an interruption in the transmission during the breaks in speech (VAD, Voice Activity Detection), require an exclusively allocated transmission channel DCH for these services. In this transmission channel DCH, the transmission of time-critical information zki is not delayed by the transmission of non-time-critical information nzki from other subscriber stations MSX.

By contrast, transmission channels DSCH with shared use are not exclusively allocated to a transmission to a ~~plurality~~ number of subscriber stations MSS1 and MSS2. They are used by different subscriber stations MSS1, MS2 for non-time-critical information nzki~~,~~; for example, delayed transmissions of data packets. For non-time-critical information nzki transmitted in transmission channels with shared use, signaling known from the GPRS system is used, for example, where the much longer delays are accepted by the signaling for the non-time-critical information nzki. The relatively long delay is unacceptable for transmitting time-critical information zki, however.

According to the present invention, in the breaks in the transmission of the time-critical information zki, non-time-critical information nzki from other subscriber stations MSX is additionally transmitted in the same transmission channel DCH. A sequence for the inventive method is illustrated in this regard in FIGURE 3.

An illustrative frame structure for the radio interface in a TDD transmission method can be seen in FIGURE 2. In line with a TDMA component, provision is made for splitting a broadband frequency band fb~~,~~; for example, having the bandwidth of 5 MHz. A transmission resource UR is defined by a frequency band fb, a spreading code sk and a time slot ts. Good separation is possible using orthogonal spreading codes. A transmission resource UR is the smallest unit which can be allocated to a subscriber station MS, MSX, MSS1 or MSS2 for data transmission. Within a broadband frequency band fb, the consecutive time slots ts are structured on the basis of a frame structure. Thus, 15 time slots ts0 to ts14 are combined to form one frame rh.

When using the TDD transmission method, some of the time slots ts1 to ts14 are used in the uplink and some of the time slots ts0 to ts14 are used in the downlink, with transmission in the downlink taking place before transmission in the uplink, for example. In between, there is a switching instant SP which is positioned flexibly on the basis of the respective need for transmission channels DCH, DSCH for the uplink and the downlink.

Channel pooling is used to allocate one or more transmission resources UR to a communication link in each case.

The channel pooling method is advantageously used to produce communication links to and from subscriber stations MS, MSX using different data rates or to operate a ~~plurality~~ number of services in parallel on one communication link. To this end, a ~~plurality~~ number of transmission resources UR are combined for transmission for one connection.

Within the frame rh, a first signaling channel RACH in the uplink, the general signaling channel BCCH, and a second signaling channel FACH in the downlink are shown by way of example. While the general signaling channel BCCH and the second signaling channel FACH require only one transmission resource UR, the first signaling channel RACH ~~comprises~~ includes the transmission resources UR of a whole time slot ts.

Below the frame rh, the structure of the first signaling channel RACH is shown. The first signaling channel RACH contains consecutive subchannels SUB defined by spreading code sk and transmission time sts within the time slot ts. A first portion of the subchannels SUB, shown without shading in FIGURE 2, is used by the subscriber stations MS, MSX, MSS1 and MSS2 for random multiple access. In addition, a second portion of the subchannels SUB, shown with shading in FIGURE 2, is exclusively allocated to subscriber stations MS for signaling~~,~~; for example, signaling the transmission of time-critical information zki within existing logical connections.

The split of the subchannels SUB into the first and second portions is configured by the base station BS and is signaled to the subscriber stations MS, MSX, MSS1 and MSS2 via the general signaling channel BCCH. By way of example, all the transmission times sts for a spreading code sk are allocated to one portion of the subchannels SUB (not shown in FIGURE ~~2).Alternatively~~ 2).

Alternatively, all the spreading codes sk for a transmission time sts are allocated to one portion of the subchannels. FIGURE 2 shows a free split by the base station BS, as configured on the basis of the number of random multiple access operations, for example.

FIGURE 3 shows, schematically, the sequence of the inventive method between a base station BS and two subscriber stations MS and MSX. In this example, the subscriber station MS needs to transmit time-critical information zki to the base

station BS. While the subscriber station MSX needs to transmit only non-time-critical information nzki to the base station BS. The sequence takes place along a time axis t.

In step 1, signaling information is transmitted from the base station BS to the subscriber stations MS and MSX via the general signaling channel BCCH. In this case, some of the signaling information is the split for the subchannels SUB of the first signaling channel RACH into a first portion for random multiple access and into a second portion for signaling within existing logical connections.

To set up a logical connection, the subscriber station MS evaluates the signaling information in step 2. The user uses the subscriber station MS to request one or more transmission resources UR for the logical connection in order to transmit time-critical information zki. To this end, the subscriber station MS uses a random multiple access method in step 3 to send signaling to request the transmission resources UR for the time-critical information zki to the base station BS in the first portion of the subchannels SUB of the first signaling channel RACH.

To set up a further logical connection, the subscriber station MSX evaluates the signaling information instep 4. The user uses the subscriber station MSX to request at least the further logical connection for transmitting non-time-critical information nzki. To this end, the subscriber station MSX uses a random multiple access method in step 5 to send signaling to request the connection for the non-time-critical information nzki to the base station BS in the first portion of the subchannels SUB of the first signaling channel RACH.

In step 6, the base station BS evaluates the signaling received in the first signaling channel RACH. For both subscriber stations MS and MSX, logical connections are set up and signaled. To set up the connections, further signaling is advantageous~~,~~ (for example, for the purposes of identification or authentication), which are not shown in FIGURE 3 for the sake of simplicity.

The subscriber station MS is exclusively allocated, by way of example, a transmission resource UR within the logical connection. In addition, the subscriber station MS is exclusively allocated a subchannel SUB of the second portion for the purposes of collision-free signaling of requests for the transmission resource UR for transmitting the time-critical information zki. A further exclusively allocated

subchannel SUB of the second portion is provided for measurements of transmission conditions in the radio interface.

In step 7, the allocations are signaled to the subscriber station MS. In step 8, the allocations are signaled to the subscriber station MSX~~,~~; for example, in the second signaling channel FACH. The subscriber station MSX then enters standby mode. Beforehand, in step 6, the subscriber station MSX is allocated the same transmission resource UR within a further logical connection for transmitting the non-time-critical information nzki. In addition, the subscriber station MSX is allocated a subchannel SUB of the second portion for measurements of transmission conditions in the radio interface. These subchannels SUB for measurement for the two subscriber station MS and MSX are transmitted alternately using the same spreading code sk and transmission time sts but in different frames.

In step 9, data are available for transmission in the subscriber station MS~~,~~ and, in step 10, the subscriber station MS subsequently sends the request for the transmission resource UR to the base station BS continuously in the subchannel SUB of the first portion. The base station makes the transmission channel DCH available in step 11 and, in step 12, sends the channel available signal to the subscriber station MS in the second signaling channel FACH.

In step 13, the subscriber station MS ~~then~~ continues to send the time-critical information zki to the base station BS up until a break~~, i.e.~~ (i.e., until there is no time-critical information zki for transmission), so that, from step 14 onward, there is no longer any signaling sent by the subscriber station MS in the subchannel SUB of the first portion for the purposes of requesting the transmission resource UR.

During the described time period for steps 9 to 14, the other subscriber station MSX waits for the opportunity to transmit the non-time-critical information nzki. For this purpose, the information is buffer-stored in a queue in step 15. During the time period, the other subscriber station MSX sends measurement signals, once or a ~~plurality~~ number of times, to the base station BS in the subchannel SUB in step 16.

When the break in the transmission of the time-critical information zki, which is signaled in step 14, is evaluated, the base station BS sends signaling to make the transmission resource UR available for the non-time-critical information nzki to the other subscriber station MSX in the second signaling channel FACH in step 17. The

other subscriber station MSX then sends the information nzki to the base station BS in step 18.

In step 18, the present invention is particularly advantageously combined in connection with a method (ARQ) for repeated sending of incorrectly received data. Data received with interference are detected, signaled to the transmission end and transmitted again by the latter. Particularly for non-time-critical information nzki~~,~~ (for example, packet data for an e-mail), a data packet of the non-time-critical information nzki which has been transmitted only incompletely ~~on account of~~ due to the end of the break in the transmission of the time-critical information zki, is transmitted again within the next break, for example.

An end of the break is signaled by the subscriber station MS in step 19 in the exclusively allocated subchannel SUB of the second portion. The base station BS then simultaneously makes the transmission resource UR available for transmitting the time-critical information zki in step 20 and, in step 21, signals to the other subscriber station MSX that the transmission resource UR has been disabled for transmitting the non-time-critical information nzki.

Although the present invention has been described with reference to specific embodiments, those of skill in the art will recognize that changes may be made thereto without departing from the spirit and scope of the invention as set forth in the hereafter appended claims.

~~Abstract~~

ABSTRACT OF THE DISCLOSURE

~~Method for allocating transmission resources to the uplink in a radio transmission~~

~~In a~~ A method for allocating transmission resources to the uplink in a TD-CDMA radio interface, wherein a ~~plurality~~ number of time slots are combined in one frame~~. A~~, a first signaling channel within the frame contains consecutive subchannels~~.~~ ~~The~~, the subchannels are defined by spreading code and transmission time within the time slot~~. A~~, a first portion of the subchannels is used by subscriber stations for random multiple access, and ~~additionally~~ a second portion of the subchannels is exclusively allocated to subscriber stations for signaling in logical connections.

~~FIGURE 2~~

GR 99 P 2667

3/prts

Description

Method for allocating transmission resources to the uplink in a radio transmission

The invention relates to a method for allocating transmission resources to the uplink from subscriber stations to a base station in a radio communications system.

In radio communications systems, messages (speech, image information or other data) are transmitted via transmission channels using electromagnetic waves (radio interface). The messages are transmitted both in the downlink from the base station to the subscriber station and in the uplink from the subscriber station to the base station.

DE 198 10 285.2 discloses that the signal sources are distinguished, and hence the signals are evaluated, using methods known as frequency division multiplexing (FDMA), time division multiplexing (TDMA) or code division multiplexing (CDMA), which can also be combined with one another. One form of time division multiplexing (TDMA) is the TDD (time division duplex) transmission method, in which a common frequency band is used to transmit both in the uplink, i.e. from the base station to the subscriber station, and in the downlink from the subscriber station to the base station.

To transmit data between two communications terminals, it is possible to call upon connection-oriented concepts and concepts based on logical connections. For connection-oriented data transmissions, it is necessary to provide transmission resources between the two communications terminals throughout the data transmission.

For data transmission using logical connections, permanent provision of transmission resources is not necessary. An example of such data transmission is packet data transmission. In this case, there is a logical connection between the two subscriber stations throughout data transmission, but transmission resources are provided only during the actual transmission times for the data packets. This method is based on transmission of the data in short data packets, between which relatively long breaks can arise. In the breaks between the data packets, transmission resources are available for other logical connections. With reference to one logical connection, transmission resources are saved.

The packet data transmission method known from German patent specification DE 44 02 930 A1 is particularly suitable for communications systems with limited transmission resources. However, it was developed for transmitting non-time-critical information, where delay times in transmitting the information, particularly in the uplink, are not relevant. The base station in a communications system can react to time-critical information arriving in the network by appropriately classifying the transmission resources in the downlink. For the uplink, this is not possible, since allocation of the radio resources is performed in the network. In particular, it is not possible to coordinate the subscriber stations with one another, which means that information can be transmitted only with very long delays.

DE 197 34 935 discloses a method in which a base station takes a request as a basis for allocating transmission resources in the uplink to this subscriber station. However, the request is made by the subscriber station using a multiple access operation, which is known from the GSM mobile radio system, for

example. The complex signaling and the likelihood of collision

during multiple access mean that very long delay times have to be accepted.

The invention is based on the object of specifying a method for allocating transmission resources for the transmission of information which is more appropriate for time-critical applications. This object is achieved by the method having the features of patent claim 1. Advantageous developments of the invention can be found in the subclaims.

In the inventive method for allocating transmission resources to the uplink in a radio interface between subscriber station (MS) and a base station (BS) in a TD-CDMA communications system, a plurality of time slots are combined in one frame for the radio interface. The transmission resources can respectively be allocated to a subscriber station for data transmission, the transmission resources being defined by a frequency band, a spreading code and a time slot. Spreading codes are also known within a CDMA system as CDMA codes.

A first signaling channel, formed by the transmission resources of a time slot, within the frame contains a plurality of subchannels. The subchannels are defined by spreading code for the transmission resource and transmission time within the time slot. A first portion of the subchannels is used by the subscriber stations for random multiple access, and additionally a second portion of the subchannels is exclusively allocated to subscriber stations for the purposes of signaling within logical connections.

In contrast to the subchannels, used by the random multiple access, of the first portion, the subchannels of the second portion are exclusively allocated to subscriber stations. Since random multiple access involves a plurality of subscriber stations being able

to access a subchannel of the first portion simultaneously, a collision is likely. For exclusively allocated subchannels

of the second portion, on the other hand, a collision can be ruled out and hence the delay before the use of the transmission resources for time-critical information in the uplink is significantly reduced.

On account of the exclusive allocation, additional signaling in the downlink to confirm the signaling to the subscriber station, as is customary during random multiple access, is not necessary. In this case, the subscriber station does not wait for confirmation, but rather immediately starts to transmit the time-critical information.

To increase the reliability of signaling, additional confirmation is advantageous if the transmission conditions hold a risk of incorrect signaling. In this case, the subscriber station waits for confirmation by the base station before transmitting the time-critical information.

For the purposes of signaling in logical connections, the inventive method requires only few resources for signaling, which means that signaling is effected in just a few milliseconds.

In one advantageous refinement of the invention, the split of the subchannels into the first and second portions is configured by the base station and is signaled to the subscriber stations via a general signaling channel.

In contrast to fixed splitting of the subchannels, configuration by the base station permits matching to various criteria, for example to the volume of radio traffic. Thus, the split can be configured on the basis of the number of existing connections, the number of random multiple access operations or the number of

logical connections for transmitting time-critical information.

Advantageously, the split is configured cyclically. With cyclic configuration, the resources required for signaling the configuration are used more effectively. If the configuration is updated cyclically only every 30 seconds, for example, the amount of resources used up is very small.

With particular advantage, the second portion of the subchannels is provided for collision-free signaling of requests by the subscriber station for transmission resources for transmitting time-critical information.

The transmission of time-critical information presupposes that the delay before transmission resources are used is short. For transmitting voice information, the delay must not exceed 100 milliseconds. To use the transmission resources effectively in the uplink, the invention proposes that, during breaks in the transmission of time-critical information, non-time-critical information be transmitted by other subscriber stations using the same transmission resource.

The inventive method guarantees that the delay before the transmission resource is used for transmitting the time-critical information does not exceed a maximum value. The maximum value is significantly below that for random multiple access and, with a suitable choice of other system parameters (shallow interleaving depth), is less than 40 milliseconds.

With particular advantage, an exclusive allocation of a transmission resource to the respective subscriber station is temporarily canceled during the breaks in the transmission of time-critical information signaled by the subscriber station, and the transmission resource is used to transmit non-time-critical information from other subscriber stations

to the base station within a logical connection.

The breaks in the transmission of time-critical information are detected by the base station. In this case, various methods are advantageously used for detection which can also be combined with one another.

First, the breaks are detected by evaluating the signaling in the subchannel of the second portion. The subchannel is exclusively allocated to the subscriber station transmitting time-critical information. If, by way of example, the subscriber station sends no signaling in the subchannel, the base station makes the transmission resource used available for transmitting non-time-critical information from other subscriber stations.

Secondly, the breaks are detected by evaluating an interruption in the data stream. If transmission of the time-critical information is interrupted, then a break is established after a fixed time interval or a time interval configured on the basis of transmission conditions or the load of radio traffic, and the base station makes the transmission resource used available for transmitting non-time-critical information from other subscriber stations.

Thirdly, the breaks are detected by virtue of the time-critical information containing signaling relating to an interruption in the transmission of the time-critical information evaluated by the base station or a network device.

Applications using non-time-critical information are, by way of example, e-mail, or Internet data, for which only a low quality of service (QoS) is required. Such information can also be transmitted with a relatively long delay.

The base station advantageously takes the request as a basis for signaling termination of the non-time-critical information from the respective other subscriber station and allocation of the transmission resource for transmitting the time-critical information. The signaling is effected, by way of example, simultaneously using a second signaling channel. Thus, the base station controls the distribution of transmission resources in the uplink, without continually needing to allocate a transmission resource exclusively to a transmission of time-critical information. Coordination of the transmissions in the uplink is therefore controlled by the base station or a network device.

In an alternative refinement of the invention, the second portion of the subchannels is provided for measurements of transmission conditions in the radio interface. During a logical connection, temporarily no information is transmitted. To ensure that the transmission conditions in the radio interface are nevertheless measured during the transmission breaks, a measurement signal is transmitted as signaling in a subscriber station's exclusively allocated subchannels of the second portion. This signaling can be effected, by way of example, cyclically or at the request of the base station. The measurement needs to be updated only at long time intervals, for example 2 seconds. Exclusive allocation of the subchannel is thus effected only for a limited time period controlled cyclically by the base station at relatively long time intervals. Thus, a plurality of subscriber stations alternately transmit one or more measurement signals within a subchannel which, however, is exclusively allocated in this time slot, which means that only few resources are used up.

Advantageously, the measurements of the transmission conditions are evaluated for the purposes of

transmitted power regulation, frame synchronization and ascertaining a timing advance.

During long transmission breaks within logical connections, the transmitted power, frame synchronization and timing advance are thus updated cyclically, and hence a collision on account of altered signal delay times is prevented and the interference on account of unregulated transmitted powers is reduced.

The subchannels of the second portion are advantageously used for a plurality of different signaling operations and measurements. Thus, the measurement of the transmission conditions is advantageously combined with the collision-free request.

The invention is explained in more detail below using exemplary embodiments with reference to illustrations in the drawings, in which

FIGURE 1 shows a block diagram of a radio communications system, in particular of a mobile radio system,

FIGURE 2 shows a schematic illustration of the radio interface between base stations and subscriber stations, and

FIGURE 3 shows a schematic illustration of the sequence of the inventive method.

The radio communications system shown in FIGURE 1, and, by way of example, in the form of a mobile radio system, comprises a multiplicity of mobile switching centers SGSN which are networked among one another and set up access to a landline network PDN. In addition, these mobile switching centers SGSN are connected to at least one respective device for allocating radio resources RNC. Each of these devices RNC in turn allows a connection to at least one base station BS.

This base station BS is a radio station which can use a radio interface to set up and signal communication links to mobile or fixed subscriber stations MS, MSX, MSS1 and MSS2. The functionality of this structure is used by the inventive method. Use in a wireless subscriber access system (access network), for example, is likewise possible in this context.

From a subscriber station MS to a base station BS, a transmission channel DCH in the uplink is exclusively allocated for the undelayed transmission of time-critical information zki. This transmission channel DCH can comprise one or more transmission resources UR, as shown in more detail in Figure 2. This transmission channel DCH is designed for the maximum values of greatly fluctuating data rates. Particularly time-critical applications with greatly fluctuating data rates which are to be transmitted with little delay, such as video transmissions or voice transmissions with an interruption in the transmission during the breaks in speech (VAD, Voice Activity Detection), require an exclusively allocated transmission channel DCH for these services. In this transmission channel DCH, the transmission of time-critical information zki is not delayed by the transmission of non-time-critical information nzki from other subscriber stations MSX.

By contrast, transmission channels DSCH with shared use are not exclusively allocated to a transmission to a plurality of subscriber stations MSS1 and MSS2. They are used by different subscriber stations MSS1, MS2 for non-time-critical information nzki, for example delayed transmissions of data packets. For non-time-critical information nzki transmitted in transmission channels with shared use, signaling known from the GPRS system is used, for example, where the much longer delays are accepted by the signaling

for the non-time-critical information nzki. The relatively long delay is unacceptable for transmitting time-critical information zki, however.

According to the invention, in the breaks in the transmission of the time-critical information zki, non-time-critical information nzki from other subscriber stations MSX is additionally transmitted in the same transmission channel DCH. A sequence for the inventive method is illustrated in this regard in FIGURE 3.

An illustrative frame structure for the radio interface in a TDD transmission method can be seen in FIGURE 2. In line with a TDMA component, provision is made for splitting a broadband frequency band fb, for example having the bandwidth of 5 MHz. A transmission resource UR is defined by a frequency band fb, a spreading code sk and a time slot ts. Good separation is possible using orthogonal spreading codes. A transmission resource UR is the smallest unit which can be allocated to a subscriber station MS, MSX, MSS1 or MSS2 for data transmission. Within a broadband frequency band fb, the consecutive time slots ts are structured on the basis of a frame structure. Thus, 15 time slots ts0 to ts14 are combined to form one frame rh.

When using the TDD transmission method, some of the time slots ts1 to ts14 are used in the uplink and some of the time slots ts0 to ts14 are used in the downlink, with transmission in the downlink taking place before transmission in the uplink, for example. In between, there is a switching instant SP which is positioned flexibly on the basis of the respective need for transmission channels DCH, DSCH for the uplink and the downlink.

Channel pooling is used to allocate one or more transmission resources UR to a communication link in each case.

The channel pooling method is advantageously used to produce communication links to and from subscriber stations MS, MSX using different data rates or to operate a plurality of services in parallel on one communication link. To this end, a plurality of transmission resources UR are combined for transmission for one connection.

Within the frame rh, a first signaling channel RACH in the uplink, the general signaling channel BCCH, and a second signaling channel FACH in the downlink are shown by way of example. While the general signaling channel BCCH and the second signaling channel FACH require only one transmission resource UR, the first signaling channel RACH comprises the transmission resources UR of a whole time slot ts.

Below the frame rh, the structure of the first signaling channel RACH is shown. The first signaling channel RACH contains consecutive subchannels SUB defined by spreading code sk and transmission time sts within the time slot ts. A first portion of the subchannels SUB, shown without shading in FIGURE 2, is used by the subscriber stations MS, MSX, MSS1 and MSS2 for random multiple access. In addition, a second portion of the subchannels SUB, shown with shading in FIGURE 2, is exclusively allocated to subscriber stations MS for signaling, for example signaling the transmission of time-critical information zki within existing logical connections.

The split of the subchannels SUB into the first and second portions is configured by the base station BS and is signaled to the subscriber stations MS, MSX, MSS1 and MSS2 via the general signaling channel BCCH. By way of example, all the transmission times sts for a spreading code sk are allocated to one portion of the subchannels SUB (not shown in FIGURE 2).

Alternatively, all the spreading codes sk for a transmission time sts are allocated to one portion of the subchannels. FIGURE 2 shows a free split by the base station BS, as configured on the basis of the number of random multiple access operations, for example.

FIGURE 3 shows, schematically, the sequence of the inventive method between a base station BS and two subscriber stations MS and MSX. In this example, the subscriber station MS needs to transmit time-critical information zki to the base station BS. While the subscriber station MSX needs to transmit only non-time-critical information nzki to the base station BS. The sequence takes place along a time axis t.

In step 1, signaling information is transmitted from the base station BS to the subscriber stations MS and MSX via the general signaling channel BCCH. In this case, some of the signaling information is the split for the subchannels SUB of the first signaling channel RACH into a first portion for random multiple access and into a second portion for signaling within existing logical connections.

To set up a logical connection, the subscriber station MS evaluates the signaling information in step 2. The user uses the subscriber station MS to request one or more transmission resources UR for the logical connection in order to transmit time-critical information zki. To this end, the subscriber station MS uses a random multiple access method in step 3 to send signaling to request the transmission resources UR for the time-critical information zki to the base station BS in the first portion of the subchannels SUB of the first signaling channel RACH.

To set up a further logical connection, the subscriber station MSX evaluates the signaling information in

step 4. The user uses the subscriber station MSX to request at least the further logical connection for transmitting non-time-critical information nzki. To this end, the subscriber station MSX uses a random multiple access method in step 5 to send signaling to request the connection for the non-time-critical information nzki to the base station BS in the first portion of the subchannels SUB of the first signaling channel RACH.

In step 6, the base station BS evaluates the signaling received in the first signaling channel RACH. For both subscriber stations MS and MSX, logical connections are set up and signaled. To set up the connections, further signaling is advantageous, for example for the purposes of identification or authentication, which are not shown in FIGURE 3 for the sake of simplicity.

The subscriber station MS is exclusively allocated, by way of example, a transmission resource UR within the logical connection. In addition, the subscriber station MS is exclusively allocated a subchannel SUB of the second portion for the purposes of collision-free signaling of requests for the transmission resource UR for transmitting the time-critical information zki. A further exclusively allocated subchannel SUB of the second portion is provided for measurements of transmission conditions in the radio interface.

In step 7, the allocations are signaled to the subscriber station MS. In step 8, the allocations are signaled to the subscriber station MSX, for example in the second signaling channel FACH. The subscriber station MSX then enters standby mode. Beforehand, in step 6, the subscriber station MSX is allocated the same transmission resource UR within a further logical connection for transmitting the non-time-critical information nzki. In addition, the subscriber station

MSX is allocated a subchannel SUB of the second portion for measurements of transmission conditions in the

radio interface. These subchannels SUB for measurement for the two subscriber station MS and MSX are transmitted alternately using the same spreading code sk and transmission time sts but in different frames.

In step 9, data are available for transmission in the subscriber station MS, and, in step 10, the subscriber station MS subsequently sends the request for the transmission resource UR to the base station BS continuously in the subchannel SUB of the first portion. The base station makes the transmission channel DCH available in step 11 and, in step 12, sends the channel available signal to the subscriber station MS in the second signaling channel FACH.

In step 13, the subscriber station MS then continues to send the time-critical information zki to the base station BS up until a break, i.e. until there is no time-critical information zki for transmission, so that, from step 14 onward, there is no longer any signaling sent by the subscriber station MS in the subchannel SUB of the first portion for the purposes of requesting the transmission resource UR.

During the described time period for steps 9 to 14, the other subscriber station MSX waits for the opportunity to transmit the non-time-critical information nzki. For this purpose, the information is buffer-stored in a queue in step 15. During the time period, the other subscriber station MSX sends measurement signals, once or a plurality of times, to the base station BS in the subchannel SUB in step 16.

When the break in the transmission of the time-critical information zki, which is signaled in step 14, is evaluated, the base station BS sends signaling to make the transmission resource UR available for the non-time-critical information nzki to the other subscriber

station MSX in the second signaling channel FACH in step 17. The other subscriber station MSX then sends the information nzki to the base station BS in step 18.

In step 18, the invention is particularly advantageously combined in connection with a method (ARQ) for repeated sending of incorrectly received data. Data received with interference are detected, signaled to the transmission end and transmitted again by the latter. Particularly for non-time-critical information nzki, for example packet data for an e-mail, a data packet of the non-time-critical information nzki which has been transmitted only incompletely on account of the end of the break in the transmission of the time-critical information zki is transmitted again within the next break, for example.

An end of the break is signaled by the subscriber station MS in step 19 in the exclusively allocated subchannel SUB of the second portion. The base station BS then simultaneously makes the transmission resource UR available for transmitting the time-critical information zki in step 20 and, in step 21, signals to the other subscriber station MSX that the transmission resource UR has been disabled for transmitting the non-time-critical information nzki.

Patent claims

1. A method for allocating transmission resources (UR) to the uplink in a radio interface between subscriber stations (MS,MSX) and a base station (BS) in a communications system,
where a plurality of time slots (ts) are combined in one frame (rh) for the radio interface,
in which the transmission resources (UR), defined by a frequency band (fb), a spreading code (sk) and a time slot (ts), can respectivey be allocated to a subscriber station (MS) for data transmission,
a first signaling channel (RACH), formed by the transmission resources (UR) of a time slot (ts), within the frame (rh) contains a plurality of subchannels (SUB) which are defined by spreading code (sk) for the transmission resource (UR) and transmission time (sts) within the time slot (ts),
a first portion of the subchannels (SUB) is used by the subscriber stations (MS,MSX,MSS1,MSS2) for random multiple access, and
additionally a second portion of the subchannels (SUB) is exclusively allocated to subscriber stations (MS) for the purposes of signaling within existing logical connections.

2. The method as claimed in claim 1, in which
the split of the subchannels (SUB) into the first and second portions is configured by the base station (BS) and is signaled to the subscriber stations (MS,MSX,MSS1,MSS2) via a general signaling channel (BCCH).

3. The method as claimed in claim 2, in which
the split is configured on the basis of the number of random multiple access operations.

4. The method as claimed in claim 2, in which

the split is configured on the basis of the number of logical connections for transmitting time-critical information (zki).

5. The method as claimed in one of claims 2 to 4, in which the split is configured cyclically.

6. The method as claimed in one of the preceding claims, in which at least one subchannel (SUB) of the second portion is provided for collision-free signaling of requests by the subscriber stations (MS) for transmission resources (UR) for transmitting time-critical information (zki).

7. The method as claimed in one of claims 1 to 5, in which at least one subchannel (SUB) of the second portion is provided for measurements of transmission conditions in the radio interface.

8. The method as claimed in claim 7, in which the measurements of the transmission conditions are evaluated for the purposes of transmitted power regulation.

9. The method as claimed in one of claims 7 or 8, in which the measurements of the transmission conditions are evaluated for the purposes of frame synchronization.

10. The method as claimed in one of claims 7 or 8, in which the measurements of the transmission conditions are evaluated for the purposes of ascertaining a timing advance.

11. The method as claimed in claim 6, in which an exclusive allocation of a transmission resource (UR) to the respective subscriber station (MS) is temporarily canceled during breaks in the transmission of time-critical information (zki) signaled by the

subscriber station (MS), and

the transmission resource (UR) is used to transmit non-time-critical information (nzki) from other subscriber stations (MSX) to the base station (BS) within a logical connection.

12. The method as claimed in claim 11, in which the base station (BS) takes the request as a basis for signaling termination of the transmission of the non-time-critical information (nzki) from the respective other subscriber station (MSX) and allocation of the transmission resource (UR) for transmitting the time-critical information (zki), using a second signaling channel (FACH).

GR 99 P 2667

Abstract

Method for allocating transmission resources to the uplink in a radio transmission

In a method for allocating transmission resources to the uplink in a TD-CDMA radio interface, a plurality of time slots are combined in one frame. A first signaling channel within the frame contains consecutive subchannels. The subchannels are defined by spreading code and transmission time within the time slot. A first portion of the subchannels is used by subscriber stations for random multiple access, and additionally a second portion of the subchannels is exclusively allocated to subscriber stations for signaling in logical connections.

FIGURE 2

FIG 1

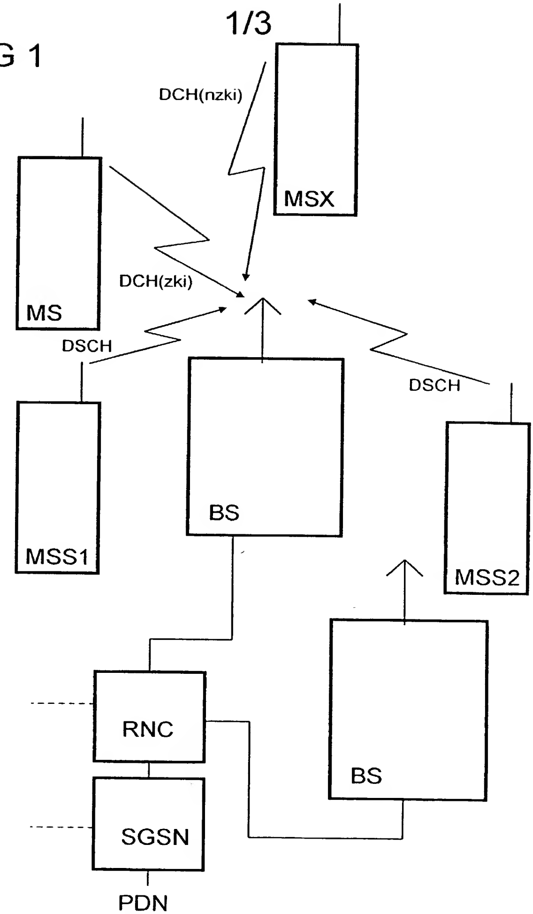


FIG 2

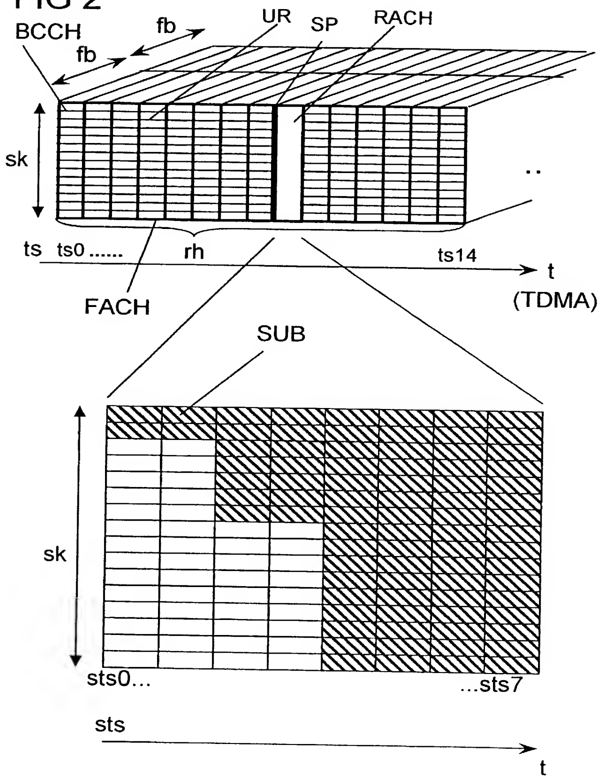
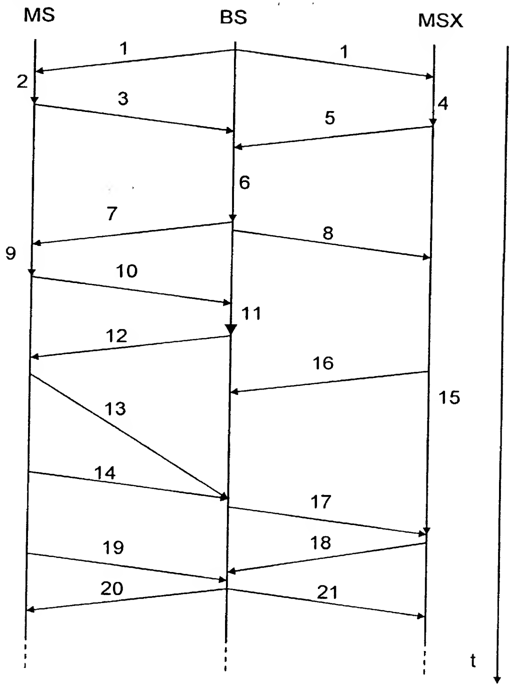

BCCH
fb
fb
UR
SP
RACH
sk
ts
ts0 ......
rh
ts14
t
(TDMA)
FACH
SUB
sk
sts0...
...sts7
sts
t

FIG 3



Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht
German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

Verfahren zum Zuweisen von Übertragungsressourcen der Aufwärtsrichtung einer Funkübertragung

deren Beschreibung

(zutreffendes ankreuzen)
☐ hier beigefügt ist.
☒ am 22.08.2000 als
PCT internationale Anmeldung
PCT Anmeldungsnummer PCT/DE00/02859
eingereicht wurde und am _______
abgeändert wurde (falls tatsächlich abgeändert).

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

Ich beanspruche hiermit ausländische Prioritatsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Method for allocating transmission resources of the uplink of a radio transmission

the specification of which

(check one)
☐ is attached hereto.
☒ was filed on 22.08.2000 as
PCT international application
PCT Application No. PCT/DE00/02859
and was amended on __________
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed.

German Language Declaration

Prior foreign appplications
Priorität beansprucht

Priority Claimed

19940753.3 (Number) (Nummer)	DE (Country) (Land)	27.08.1999 (Day Month Year Filed) (Tag Monat Jahr eingereicht)	☒ Yes Ja	☐ No Nein
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	☐ Yes Ja	☐ No Nein
(Number) (Nummer)	(Country) (Land)	(Day Month Year Filed) (Tag Monat Jahr eingereicht)	☐ Yes Ja	☐ No Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozeßordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35. United States Code. §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occured between the filing date of the prior application and the national or PCT international filing date of this application.

PCT/DE00/02859 **(Application Serial No.) (Anmeldeseriennummer)**	22.08.2000 **(Filing Date D, M, Y) (Anmeldedatum T, M, J)**	anhängig **(Status) (patentiert, anhängig, aufgegeben)**	pending **(Status) (patented, pending, abandoned)**
(Application Serial No) (Anmeldeseriennummer)	**(Filing Date D,M,Y) (Anmeldedatum T, M; J)**	**(Status) (patentiert, anhängig, aufgeben)**	**(Status) (patented, pending, abandoned)**

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001, Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschäfte vor dem Patent- und Warenzeichenamt *(Name und Registrationsnummer anführen)*	POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*
Customer No. 29177	29177 And I hereby appoint PATENT TRADEMARK OFFICE
Telefongespräche bitte richten an: *(Name und Telefonnummer)*	~~Direct Telephone Calls to:~~ *(name and telephone number)* Ext. ______
Postanschrift:	Send Correspondence to:

Bell, Boyd & Lloyd LLC
Three First National Plaza, 70 West Madison Street, Suite 3300 60602-4207 Chicago, Illinois
Telephone: (001) 312 372 11 21 and Facsimile (001) 312 827 8185
or
Customer No. 29177

1-02

Voller Name des einzigen oder ursprünglichen Erfinders:	Full name of sole or first inventor:
Dr. Christian Menzel	Dr. Christian Menzel
Unterschrift des Erfinders — Datum: Christian Menzel 30.1.02	Inventor's signature — Date
Wohnsitz: Maisach, DEUTSCHLAND	Residence: Maisach, GERMANY
Staatsangehorigkeit: DE	Citizenship: DE
Postanschrift: Edelweisstr. 36	Post Office Addess: Edelweisstr. 36
82216 Maisach	82216 Maisach
Voller Name des zweiten Miterfinders (falls zutreffend).	Full name of second joint inventor, if any
Unterschrift des Erfinders — Datum	Second Inventor's signature — Date
Wohnsitz: ,	Residence: ,
Staatsangehörigkeit	Citizenship
Postanschrift	Post Office Address

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).